



Selected Topics (Image Processing)

Answer all Questions

Question One

1- Apply a 3*3 averaging filter to the middle 9 values of the matrix

$$\begin{bmatrix} a & b & c & d & e \\ f & g & h & i & j \\ k & l & m & n & o \\ p & q & r & s & t \\ u & v & w & x & y \end{bmatrix}$$

then apply another 3*3 averaging filter to the result Using your answer, describe a 5*5 filter which has the effect of two averaging filters. Is this filter separable?

2- Explain what is the Geometric mean filter and Alpha trimmed mean filter , then write a Matlab code to implement those nonlinear filters(state any assumption you use in the code).

3-Two images $f(x,y)$ and $g(x,y)$, have histograms h_f and h_g . Explain how to obtain the histogram in the following cases: $f(x,y) + g(x,y)$, and $f(x,y) - g(x,y)$.

4- Draw the color cube for the RGB model, and then complete the following table

R	G	B	Color
0	0	0	-----
255	255	0	-----
255	0	255	-----
0	0	255	-----
255	255	255	-----

Question Two

1- It is required to find the DFT of the following time domain matrix $f = \begin{bmatrix} 4 & 5 \\ 3 & -7 \end{bmatrix}$ using both the

traditional 2D – DFT transformation and the FFT algorithm, then compare calculating the saving in multiplication operations in both cases.

2- A 15 x 15 Gaussian filter is applied to a 256 x 480 gray scale image using Matlab **filter2** command, what will be the output image size if the shape property was:

- i) valid ii) same iii) full

3- Draw a schematic diagram for un-sharp masking then write a Matlab code to implement this type of masking (state any assumption you use in the code).

4- What is the suitable operation to get the R.H.S image from L.H.S image, then write a Matlab code to implement this operation (state any assumption you use in the code).



Cross-Correlation Used
To Locate A Known
Target in an Image

Text Running
In Another
Direction

Question Three

1- Image processing is used often in industrial applications for detecting missing components in product assembly. The method is to store a correct image that corresponds to the correct assembly; this image is then operated with the image of the sample product.

- Write two possible operations to detect possible differences between these two images

- Write the Matlab code to perform this task

2- Given an alphabet $A = (a, b, c, d, e)$ and its probability (0.4, 0.2, 0.2, 0.1, 0.1) for each letter respectively, there are exactly two possible "shapes" of Huffman trees for A and its probability distribution, Draw two Huffman trees with different shapes?

3-

	-3	2	0	-2	-1	0	0
4	-1	-2	0	0	0	0	0
0	3	0	0	0	0	0	0
0	-1	1	0	0	0	0	0
1	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0

Given the above table of DCT coefficients, what is the zig-zag order of these coefficients?

4- Using the reflected gray code (RGC), show the decimal numbers between (0-15) that are represented by 4 bits.

Question Four

1- Explain the meaning of the following terms according to MPEG Video compression

- Temporal compression algorithms - Motion estimation - Group of pictures

2- Use two run length code methods to compress the following character A which is represented by a black and white pixels

```

1234567890123456789012345
1 BBBBBBBBBBBBBBBBBBBBBBBB
2 BBBBBBBBBBBBwwBBBBBBBBBB
3 BBBBBBBBBBBBwwBwwBBBBBBBB
4 BBBBBBBBBBBBwwBBBwwBBBBBB
5 BBBBBBBBwwBBBBBwwBBBBBBB
6 BBBBBBBBwwBBBBBBBwwBBBBBB
7 BBBBBBBwwwwwwwwwwwwBBBBBB
8 BBBBBBwwBBBBBBBBBBBBBwwBBBB
9 BBBBBBwwBBBBBBBBBBBBBwwBBBB
0 BBBBBBBBBBBBBBBBBBBBBBBB

```

3- The following table gives the number of pixels at each of the grey levels in an image with those grey values only:

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
20	40	60	75	80	75	65	55	50	45	40	35	30	25	20	30

Draw the histogram corresponding to these grey levels, and then perform histogram equalization and draw the resulting histogram.

4- Compute the DFT using the convolution theorem for the following pairs of 1-D time domain sequence:

$[2, 4, 6, 8]$ and $[-1, 2, -3, 4]$

مع أطيب التمنيات بالتوفيق - د. حاتم عبد القادر



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مع أطيب التمنيات بالتوفيق - د. حاتم عبد القادر

Course Title: Information Theory
Date: 9/6/2010 (Second term)Course Code: EEC 4237
Allowed time: 3 hrsYear: 4th
No. of Pages: (2)

Remarks: (answer the following questions... assume any missing data... answers should be supported by sketches...etc)

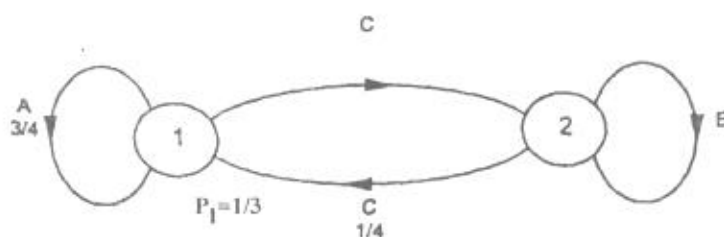
Attempt all questions

Neat answers and boxed results are appreciated

Problem number (1)

(10 Marks)

Consider the source modelled by the graph shown below. Find the source entropy H and the average information content per symbol in messages containing one, two symbols. Comment.



Problem number (2)

(20 Marks)

(a) Compare between the following two discrete channels from the point of view of mutual information.

- The first has input message such as, "00000001111111111111" while the received message was "000000011111110000111".
- The second channel has the following matrix;

$$\begin{bmatrix} \dots & 0.08 & 0.13 \\ 0.06 & \dots & 0.09 \\ 0.14 & 0.12 & \dots \\ \dots & 0.04 & 0.06 \end{bmatrix}$$

With source probabilities $[P(x)] = [0.25, \dots, 0.4, 0.17]$.

(b) Calculate;

- The channel capacity of the first channel.
- The probability of an error received on the second channel output.

Problem number (3)

(15 Marks)

- What are the methods of controlling errors?
- Consider a code with the following P matrix;

$$P = \begin{bmatrix} 1 & 1 & 0 \\ 0 & 1 & 1 \\ 1 & 0 & 1 \\ 1 & 1 & 1 \end{bmatrix}$$

- i- Determine the minimum size n of the codeword?
- ii- Which of the following is a codeword; (1001101), (0101100)?
- iii- Find the codeword C for the given message (1010). What is the Hamming weight of the resulted codeword?
- iv- If the fifth bit of the received codeword is 1, check if an error has occurred or not. If so, how does the decoder know the position of the erroneous bit.

Problem number (4)

(20 Marks)

- (a) Describe the continuous communication channel. Give it's capacity, and it's implications, and state the characteristics of ideal system.
- (b) A terminal is used to enter alphanumeric data into a computer through a telephone channel of 3400 Hz. Assume the terminal has 256 characters of independent equiprobable sequences. It is found that the obtained channel rate is 14929 bit/sec. Determine
 - a. S/N in dB.
 - b. Average information content per character.
 - c. The average character rate to be transmitted without error.
 - d. If the channel bandwidth is doubled, what will be the required S/N for the same channel rate.

Problem number (5)

(20 Marks)

- (a) Compare between using CRC and Hamming code to detect and correct any error in the received message at a channel output when the data message was "1011011010", using the polynomial $P(x) = x^4 + x^3 + 1$.
- (b) Construct a convolutional encoder with the commutator samples $C_1 = D_1$, $C_2 = D_1 \oplus D_2$, and $C_3 = D_1 \oplus D_2 \oplus D_3$. The data input stream is 1011. Find the message coded by the encoder.

Best Wishes of Success



Course Title: Information Theory
Date: 9/6/2010 (Second term)

Course Code: EEC 4202
Allowed time: 3 hrs

Year: 4th
No. of Pages: (2)

Remarks: (answer the following questions... assume any missing data... answers should be supported by sketches...etc)

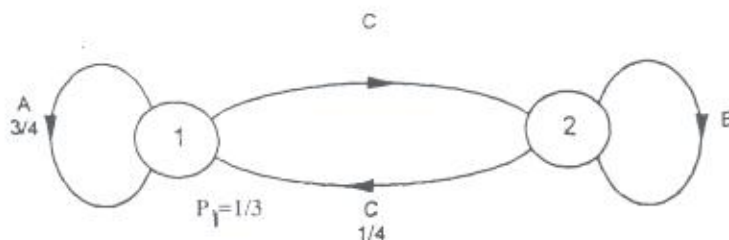
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Neat answers and boxed results are appreciated

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Best Wishes of Success

Answer the following questions:

Question 1: (Answer two points only)

- a- With the aid of sketches, explain two fiber fabrication methods.
- b- Compare between the different noise sources in a digital optical link. State there origins and methods to reduce them.
- c- Consider a fiber with 25 μm core radius, a core index $n_1=1.48$, and $\Delta=0.01$.
 - i- Derive an expression for the numerical aperture of the fiber.
 - ii- If $\lambda=1320$ nm, what is the value of V and how many modes propagate in the fiber?
 - iii- What percent of optical power flows in the cladding?
 - iv- If the core cladding difference is reduced to $\Delta=0.003$, how many modes does the fiber support and what fraction of the optical power flows in the cladding?
 - v- Comment on the results.

Question 2: (Answer two points only)

- a- Compare between the different dispersion mechanisms in an optical fiber.
- b- Explain the radiation effects on an optical fiber.
- c- Explain with the aid of sketches the idea of WDM. What is meant by DWDM?

Question 3: (Answer two points only)

- a- What is the difference between a passive star and an active repeater in a fiber network? Illustrate with sketches.
- b- Explain the error sources in an optical receiver.
- c- Explain with the aid of sketches the lasing mechanism in the laser diode.

Question 4: (Answer two points only)

- a. Explain with the aid of sketches the optical amplification mechanism.
- b. How can you build a Mach-Zhender multiplexer from couplers and phase shifters? Illustrate your answer with equations and block diagrams.
- c. How can an analog signal be transmitted with a laser diode? Show how the laser modulation is performed.

Question 5: (Answer two points only)

- a- Show the main differences between the pin and the avalanche photodiodes.
- b- How can the UV light be used to create an optical filter? Illustrate your answer with sketches?

- c- Can an optical demultiplexer be built with the aid of an optical filter? Explain how?

Question 6: (Answer two points only)

- a- Define the dynamic range of an optical Bus network. What is the significance of this parameter?
- b- From the loss point of view? Is it preferable to communicate with a Bus optical network or a Star network? Why?
- c- Explain how you can make the link power Budget in optical communications.

Question 7: (Answer one point only)

- a- Compare between optical connectors and optical splices. Give examples for connectors and splices.
- b- Can optical signal processing be performed all optically, or it is necessary to transform between optics and electronics to perform optical signal processing? Why?

Best wishes.

Tanta University
Faculty of Engineering
Electronics & Communications

4th Year, Time allowed: 3Hr.
Computer Commun. Net.
Date : 14 /6/2010 .

Answer the following questions:

1) Using diagrams, explain the following

- Objective of computer networks .
- Data flow through the computer networks
- Peer -to -Peer network.

2) In terms of the connectivity, geographic scope, noise immunity compare between the transmission media.

3) Write short notes on the following:

- Routing protocols,
- Address protocols.

4-a) Find the relationship of data link layer and network layer.

b) Determine the frame to be transmitted using CRC codes if the message M = 10100111011 and the pattern P= 10110.

5) For each term below, give the OSI model layer where that term would apply;

- | | | | |
|------------------|--------------------|----------------|---------------------|
| * Character code | * Repeaters | * Bridges | * Telephones cables |
| * MODEMs | * Routing protocol | * MAC sublayer | |

6) With the aid of sketches, explain the basic function of:

- The LANs protocol CSMA/CD
- Hubs , Routers and Switches as a LANs components.

7-a) Compare between the following ; Gigabit Ethernet and Fast Ethernet .

b) The wireless LAN are categorized according to transmission technique. Explain, using examples

===== Good luck , Prof. M. Nasr =====

Remarks: (Answer the following questions...assume any missing data...answers should be supported by sketches)

Problem number (1)

20 Marks

- a- What are the characteristics of mobile radio channel?
- b- Draw the frequency reuse pattern and distribution for 42 cells (grid of 6x7 cells) at cluster sizes of 3, 4, 7 and 9?

Problem number (2)

40 Marks

- The mobile in idle state performs (1)....., (2) and (3)..... while in dedicated state performs (4)....., (5)....., (6)....., (7)..... and (8).....
- In dedicated mode handoff the sequence of operations is (9)....., (10)....., (11)....., (12)....., (13)..... and (14).....
- In the location updating of mobile stations, the sequence of operations is (15)....., (16)....., (17)....., (18)....., (19)....., and (20).....

Problem number (3)

10 Marks

- a- What is the sequence of operations followed when there is a call to a mobile station?
- b- What is the type of each of the following messages?
 - 1) "I'm busy now please call me latter after the lecture"
 - 2) "Coca Cola can give you 6 free minutes if you buy one litre"
 - 3) "فودافون ممكن تحولك 50 قرش تخصم عند أول عملية شحن"
 - 4) empty message to 250

5)



Problem number (4)

20 Marks

What are the environmental protocols needed for the rollout of the following:

- a- Macrocell base stations
- b- Microcell base stations

Good Luck

Academic Year 2009/2010	Faculty of Engineering - Tanta University		
	Communications and Electronics Department		Final Exam - 4 th Year
	Microwave Electronics		June, 2010
	Lecturer:	Dr. Mohamed. Abd El-Rahman	Time allowed: 3 hrs.

Answer ALL Questions

Neat answers and boxed results are appreciated

Question 1

- a) Explain the process of velocity modulation in the double cavity klystron amplifier and derive an expression for the optimum distance between the two cavities (buncher and catcher).
- b) A two identical cavity klystron amplifier has the following parameters:
 beam voltage $V_o = 1000$, $I_o = 25$ mA, $R_o = 40$ k Ω , $f = 3$ GHz
 Gap spacing in either cavity: $d = 1$ mm, spacing between the two cavities $L = 4$ cm and effective shunt impedance, excluding beam loading $R_{sh} = 30$ k Ω . Determine the following:
 i) input gap voltage to give maximum voltage V_2 .
 ii) the voltage gain, neglecting the beam loading of output cavity.
 iii) the efficiency of the amplifier, neglecting the beam loading.
 iv) the beam loading conductance G_B and verify its negligence in the preceding calculations.

$$\text{Hint: } G_B = \frac{G_o}{2} \left[\beta_o^2 - \beta_o \cos \frac{\theta_g}{2} \right] \text{ and } \frac{V_o}{(V_o + V_r)^2} = \left(\frac{e}{m} \right) \frac{(2\pi n - \pi/2)^2}{8\omega^2 L^2}$$

Question 2

- (a) Derive an expression for the electronic admittance of the reflex klystron.
 (b) A reflex klystron oscillator operates under the following conditions.
 $V_o = 600$ V, $R_{sh} = 15$ k Ω , $f_r = 9$ GHz, $L = 1$ mm, $(e/m) = 1.759 \times 10^{11}$ [MKS system]
 The tube is oscillating at f_r at the peak $n = 2$ mode. Assume that the beam loading, cavity losses and transit time through the gap can be neglected.
 i) Find the value of the repeller voltage V_r .
 ii) Find the direct current necessary to give a microwave gap voltage of 200 V.
 iii) What is the electronic efficiency under this condition?

Question 3

- a) Derive an expression for the circuit equation in a TWT amplifier.
 b) Starting from the propagation constant of growing wave, derive expression for the power gain A_p of TWT amplifier.
 c) A traveling wave tube operates under the following parameters:
 Beam voltage $V_o = 2$ kV, Beam current $I_o = 4$ mA, characteristic impedance of the helix $z_o = 20$ Ω , circuit length $N = 50$ and frequency $f = 8$ GHz. Determine:
 i) the gain parameter C .
 ii) the power gain A_p in dB.
 iii) all four propagation constants.

Question(4)

- a) Derive an expression for the pinch-off voltage of a GaAs MESFET.
 b) State the advantages of the unipolar field effect transistor over the bipolar junction transistor.
 c) A GaAs MESFET has the following S-parameters at frequency 6 GHz: $S_{11} = 0.61 \angle -170^\circ$, $S_{12} = 0.0$, $S_{21} = 2.24 \angle 32^\circ$ and $S_{22} = 0.72 \angle -83^\circ$. The amplifier operates between 50 Ω terminations. Design the input and output matching networks for simultaneously conjugate matching of the transistor for maximum gain. Also determine the value of $G_{T_{u \max}}$ in dB.

Question 5

- (a) Derive expressions for the input power P_m and load power P_L for the microwave amplifier which has scattering parameters S_{11} , S_{12} , S_{21} , and S_{22} .
- (b) Write down the different definitions of the two port power gains.
- (c) An RF Amplifier is characterized by the following S-parameters:

$S_{11} = 0.3\angle -70^\circ$, $S_{12} = 0.2\angle -10^\circ$, $S_{21} = 3.5\angle 85^\circ$ and $S_{22} = 0.4\angle -45^\circ$. Furthermore, the input side of the amplifier is connected to a voltage source with $V_s = 5V\angle 0^\circ$, and impedance $Z_s = 40\Omega$. The output is utilized to drive an antenna that has an impedance of $Z_L = 73\Omega$. Assuming that the S-parameters of the amplifier are measured with reference to a $Z_o = 50\Omega$ characteristic impedance, find the following quantities:

- (i) Transducer gain G_T , unilateral transducer gain G_{TU} and available power gain G_A .
- (ii) Power delivered to the load P_L , incident power to the amplifier P_{inc} and the maximum power available from the source P_{avs} .

You may use the following relations:

Stability gain factor: $k = \frac{1 - |S_{11}|^2 - |S_{22}|^2 + |\Delta|^2}{2|S_{12}S_{21}|}$, Delta factor: $\Delta = S_{11}S_{22} - S_{12}S_{21}$

Transducer power gain $G_T = \frac{1 - |\Gamma_s|^2}{|1 - \Gamma_{in}\Gamma_s|^2} |S_{21}|^2 \frac{1 - |\Gamma_L|^2}{|1 - S_{22}\Gamma_L|^2}$ or $G_T = \frac{1 - |\Gamma_s|^2}{|1 - S_{11}\Gamma_s|^2} |S_{21}|^2 \frac{1 - |\Gamma_L|^2}{|1 - \Gamma_{out}\Gamma_L|^2}$

$$\Gamma_{em} = \frac{B_e \pm \sqrt{B_e^2 - 4|C_e|^2}}{2C_e}, \quad \Gamma_{sm} = \frac{B_s \pm \sqrt{B_s^2 - 4|C_s|^2}}{2C_s}$$

$$B_e = 1 + |S_{22}|^2 - |S_{11}|^2 - |\Delta|^2, \quad B_s = 1 + |S_{11}|^2 - |S_{22}|^2 - |\Delta|^2, \quad C_s = S_{11} - \Delta S_{22}^*, \quad C_e = S_{22} - \Delta S_{11}^*$$

Maximum available gain (the overall transducer gain) using the input and output matching sections with reflection coefficients Γ_{em} and Γ_{sm} can be expressed as:

$$G_S = \frac{1}{1 - |\Gamma_{sm}|^2}, \quad G_L = \frac{1 - |\Gamma_{em}|^2}{|1 - S_{22}\Gamma_{em}|^2}, \quad G_o = |S_{21}|^2, \quad \text{and} \quad G_{Tmax} = G_S \cdot G_o \cdot G_L$$

OR

$$G_{Tmax} = 10 \log \left[\frac{|S_{21}|}{|S_{12}|} \left(k \pm \sqrt{k^2 - 1} \right) \right] \text{ in decibels.}$$

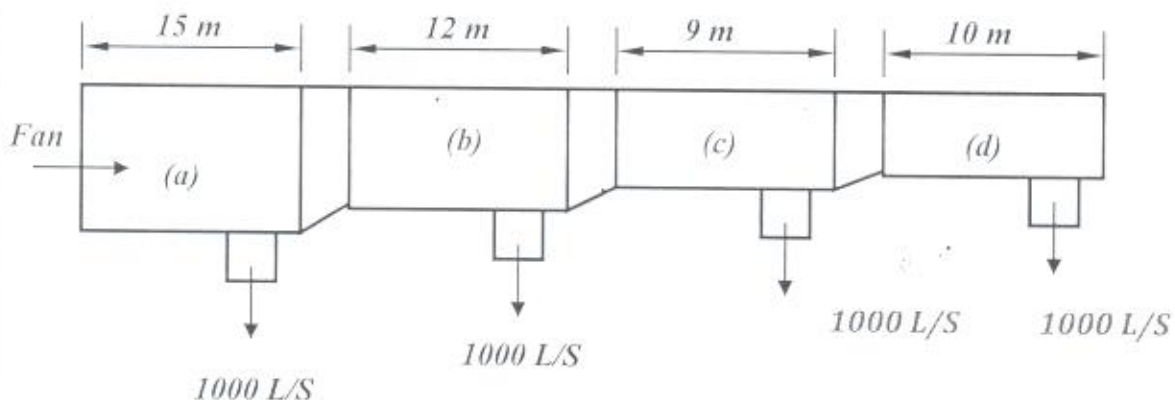
The negative sign will be used in front of the square root when B_s is positive

- 3) You have the problem of selecting a ventilating fan. The fan will be operated 4000 hours per year by an electric motor, which is 86% efficient. The cost of power is 5 PT/kW.h. A capacity of 10,000 L/S is needed in a duct system, which has a resistance of 400 Pa to air flow for this particular flow rate. The required velocity head is 95 Pa. The estimated life of the fan is 5 years. The following offers are available by three different companies:

Company	Initial cost E.P.	Fan efficiency %
A	2000	61
B	1200	58
C	1102	55

Which one would you choose and why?

- 4) Determine the sizes of ducts (a) and (b) only, for the duct system shown in the figure, using the static regain method. Round ducts are to be used.



With
The
Best
Wishes

Tanta University
Faculty of Engineering
Electronics & Communications

4th Year, Time allowed: 3Hr.
Computer Commun. Net.
Date : 12 /6/2010 .

Answer the following questions:

- 1) Using diagrams, explain the following
 - * Data flow through the computer networks .
 - * Server based network model.
 - * Hybrid topology

- 2-a) Describe the function of data link layer ,hence, state the advantage of the stop and wait method.
 b) Using sketches, draw the format of the packet switching.

- 3) Draw the flowchart of the following multiple access protocols;
 Polling - Aloha -Slotted Aloha -CSMA/CD. Which one is less delay? Explain your answer.

- 4) Consider the received frame T= 10011000101101110 and the pattern P= 100110 ,using the CRC technique, check if the message is arrived correctly or not. If the answer is not what is correct FCS.

- 5) With the aid of sketches, explain the basic function of the transport and application layers in OSI reference model. Discuss briefly a protocol example used in each layer .

- 6) In Ethernet LAN explain the following : main component, packet format and hence, indicate the major characteristics of Gigabit Ethernet.

- 7) The following components are available in your communication lab.

Group 1
(Hubs – Routers – Switches – Gateways – UTP-cat.5 & ca.6 -Optical fiber cables)

Group 2
(Infrared LANs components –Microwave LANs components- SS LANs components)

 - a) Design a suggested solution for a network in this lab., which contain a 8 terminals connected as a server-based model.
 - b) In your design indicate the reason for your components selection.

Good luck , Prof. M. Nasr

Remarks: (Answer the following questions...assume any missing data...answers should be supported by sketches)

Problem number (1)**30 Marks**

- a- What are the GSM/GPRS network elements and their functions?
- b- Find the weight values needed in an array of two-elements to suppress a jamming signal coming from 45° ?

Problem number (2)**30 Marks**

- DOA is the acronym of (1).....
- IS-95 was based on the technology of(2).....
- The public switched telephone network can be linked to the mobile network by(3).....
- The fast fades can be observed in a distance(4).....
- The main cause of Rayleigh fading is the difference in the received signals'(5).....
- The fading phenomena in radio communication is frequency(6).....
- Narrowband signals are characterized by frequency(7)..... fading
- Broadband signals are characterized by frequency(8)..... fading
- Signal breaks because of frequency-selective fading along a signal path are(9).....frequent for a broadband signal than for a narrowband signal.
- If the symbol duration becomes smaller, the intersymbol interference effect is(10).....
- Any mobile station in the world has an identity called.....(11).....
- The new user location is always registered first in(12).....
- HSS stands for Home Subscriber(13).....
- If the cluster size is 4, this can be achieved by i and j of(14).....
- Increasing the cluster size will increase(15).....

Problem number (3)**25 Marks**

- a- Describe with sketches the CDMA communications technology?
- b- Discuss the different handoff techniques in 3G mobile system?

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No. of Pages: (2)

Remarks: (answer the following questions... assume any missing data... answers should be supported by sketches... Neat answers and boxed results are appreciated).

Question (1)

- (a) Show how to multiplex two signals one of sinusoidal waveform and the other of rectangular waveform, by using sample/hold and multiplex module 2960 E.
- (b) Explain, aided with sketch, reasons of aliasing occurrence and how can you avoid it?

Question (2)

- (a) Sketch the block diagram of the PCM (transmitter and receiver), identifying the function of different clocks used.
- (b) An audio CD has mp3 file of sampling rate 44.1 kHz with a bit depth of 16, CD tracks are usually stereo, using a left and right track. Determine the bit rate of audio CD.

Question (3)

- (a) What are the basic components of optical fiber module?
- (b) Explain how can you measure LED current with voltmeter and draw LED I/V characteristics curve.

Question (4)

- (a) Explain, aided with figures, effect of increasing the frequency of the modulating signal on power and harmonic distortion of received signal.
- (b) Using optical fiber module, sketch the required connections to transmit an electrical signal of rectangular waveform over optical fiber and receive it.
- (c) Draw the rectangular transmit signal and the received signal at 1 kHz and 100 kHz.
- (d) Discuss the losses in optical fiber.
- (e) Compare between single-mode and multi-mode fibers.
- (f) Compare between step-index and graded index fiber.

Question (5)

- (a) What are the main parts and their functions of a PABX system?
- (b) Show how you can make an outgoing call and how to redirect an incoming call.

Question (6)

- (a) State, aided with figures, the required steps to determine the wavelength and the operating frequency of the transmitting signal using a horn antenna.
- (b) Define polarization and state its main types?
- (c) Aided with figures, State the required steps to determine the polarization of the antenna.

Best Wishes of Success